FIG. 1

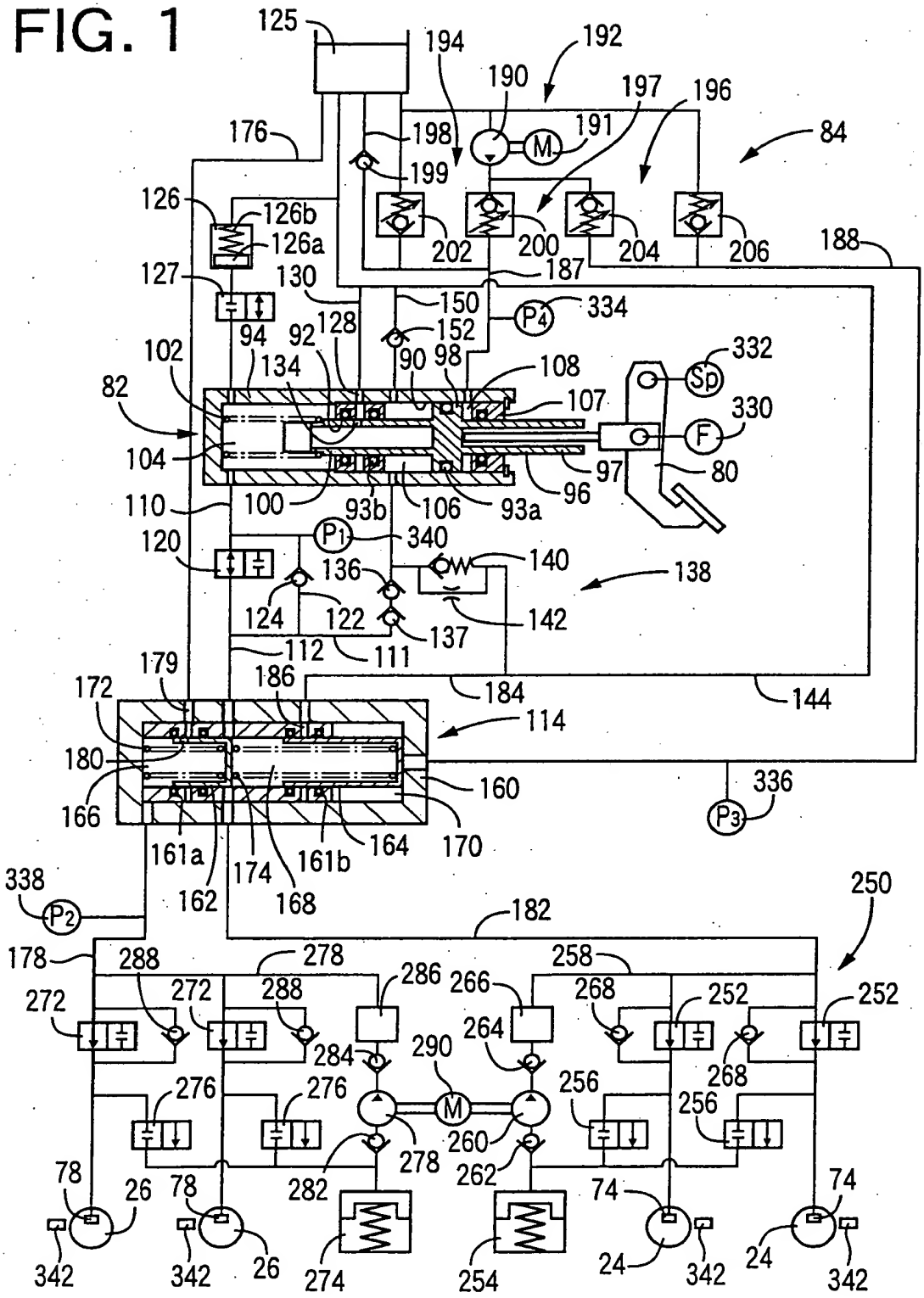

125
194
192
190
197
196
176
198
191
84
199
126
126b
126a
202
200
204
206
188
127
130
187
150
334
94
92
128
152
90
98
102
134
108
332
82
107
330
104
97
80
110
100
93b
106
93a
96
120
340
140
136
138
124
122
137
142
112
111
179
186
184
144
172
114
180
160
336
166
161a
174
161b
164
170
338
162
168
250
182
178
288
278
258
286
266
268
252
272
264
284
290
276
256
260
262
78
26
282
74
342
24
254
274

FIG. 2A

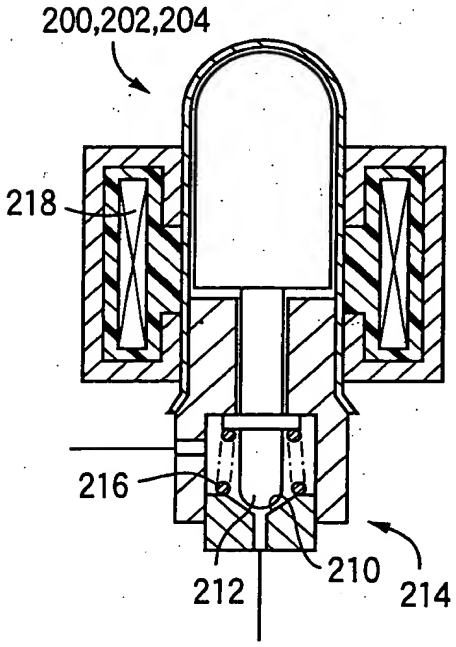


FIG. 2B

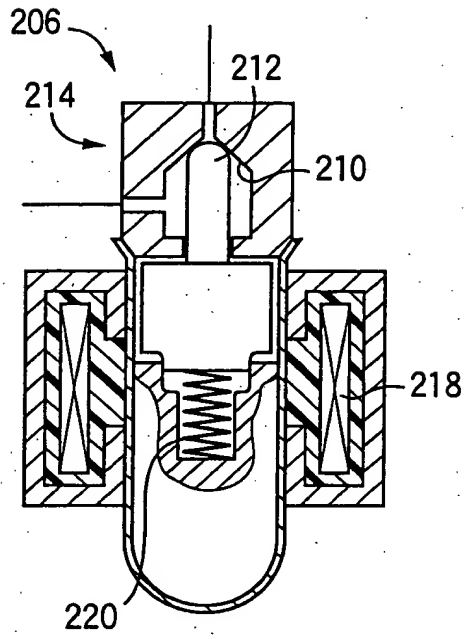


FIG. 3

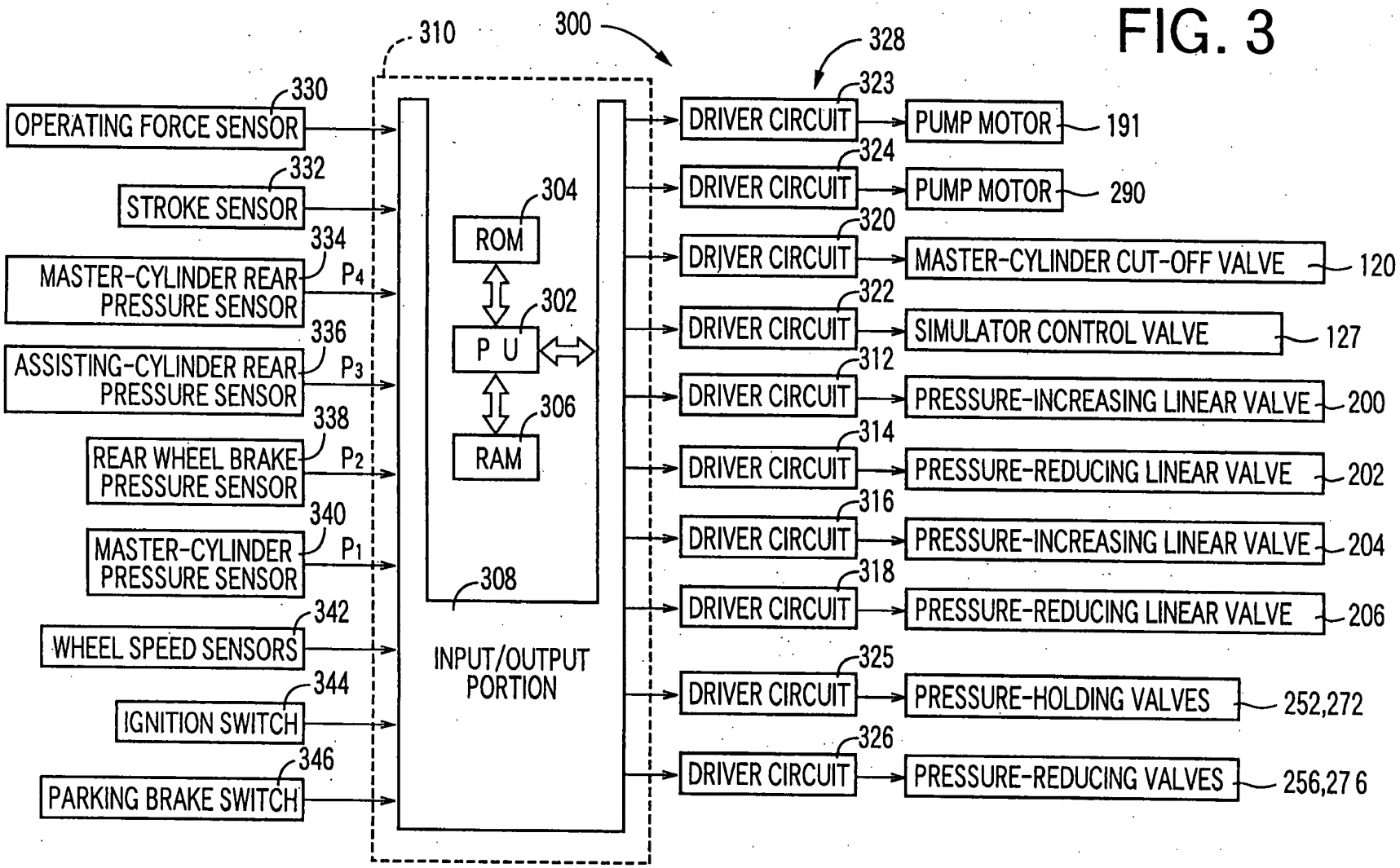

310
300
328
330
OPERATING FORCE SENSOR
332
STROKE SENSOR
334
MASTER-CYLINDER REAR PRESSURE SENSOR
P4
336
ASSISTING-CYLINDER REAR PRESSURE SENSOR
P3
338
REAR WHEEL BRAKE PRESSURE SENSOR
P2
340
MASTER-CYLINDER PRESSURE SENSOR
P1
342
WHEEL SPEED SENSORS
344
IGNITION SWITCH
346
PARKING BRAKE SWITCH
304
ROM
302
P U
306
RAM
308
INPUT/OUTPUT PORTION
323
DRIVER CIRCUIT
PUMP MOTOR
191
324
DRIVER CIRCUIT
PUMP MOTOR
290
320
DRIVER CIRCUIT
MASTER-CYLINDER CUT-OFF VALVE
120
322
DRIVER CIRCUIT
SIMULATOR CONTROL VALVE
127
312
DRIVER CIRCUIT
PRESSURE-INCREASING LINEAR VALVE
200
314
DRIVER CIRCUIT
PRESSURE-REDUCING LINEAR VALVE
202
316
DRIVER CIRCUIT
PRESSURE-INCREASING LINEAR VALVE
204
318
DRIVER CIRCUIT
PRESSURE-REDUCING LINEAR VALVE
206
325
DRIVER CIRCUIT
PRESSURE-HOLDING VALVES
252,272
326
DRIVER CIRCUIT
PRESSURE-REDUCING VALVES
256,276

FIG. 4

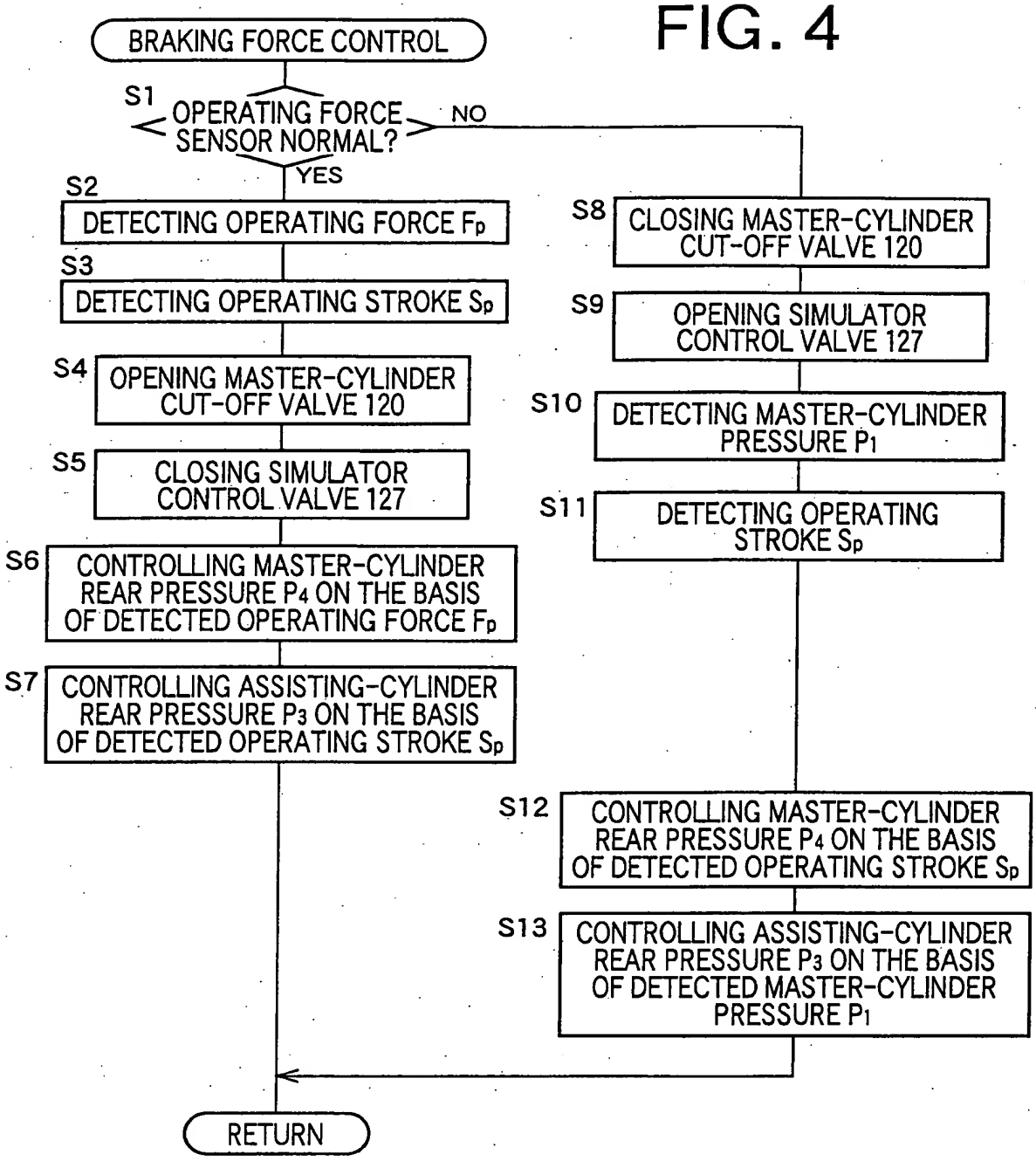

BRAKING FORCE CONTROL
S1
OPERATING FORCE SENSOR NORMAL?
NO
YES
S2
DETECTING OPERATING FORCE Fp
S3
DETECTING OPERATING STROKE Sp
S4
OPENING MASTER-CYLINDER CUT-OFF VALVE 120
S5
CLOSING SIMULATOR CONTROL VALVE 127
S6
CONTROLLING MASTER-CYLINDER REAR PRESSURE P4 ON THE BASIS OF DETECTED OPERATING FORCE Fp
S7
CONTROLLING ASSISTING-CYLINDER REAR PRESSURE P3 ON THE BASIS OF DETECTED OPERATING STROKE Sp
S8
CLOSING MASTER-CYLINDER CUT-OFF VALVE 120
S9
OPENING SIMULATOR CONTROL VALVE 127
S10
DETECTING MASTER-CYLINDER PRESSURE P1
S11
DETECTING OPERATING STROKE Sp
S12
CONTROLLING MASTER-CYLINDER REAR PRESSURE P4 ON THE BASIS OF DETECTED OPERATING STROKE Sp
S13
CONTROLLING ASSISTING-CYLINDER REAR PRESSURE P3 ON THE BASIS OF DETECTED MASTER-CYLINDER PRESSURE P1
RETURN

FIG. 5

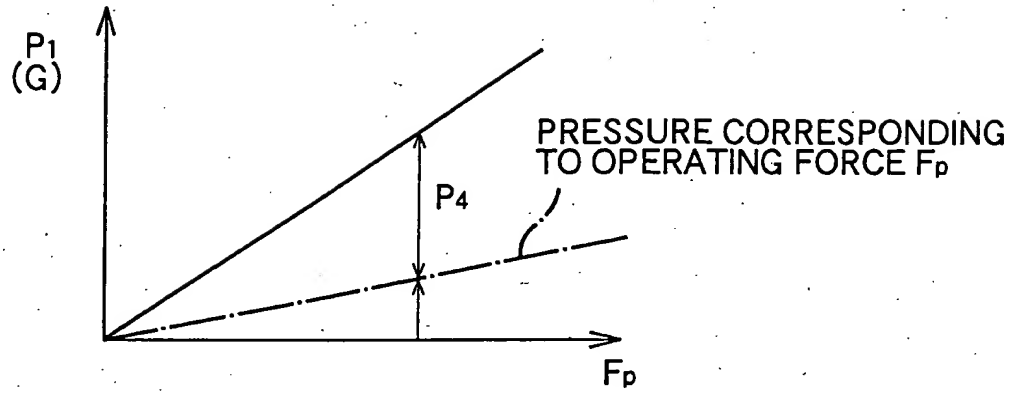

P1
(G)
PRESSURE CORRESPONDING
TO OPERATING FORCE Fp
P4
Fp

FIG. 6

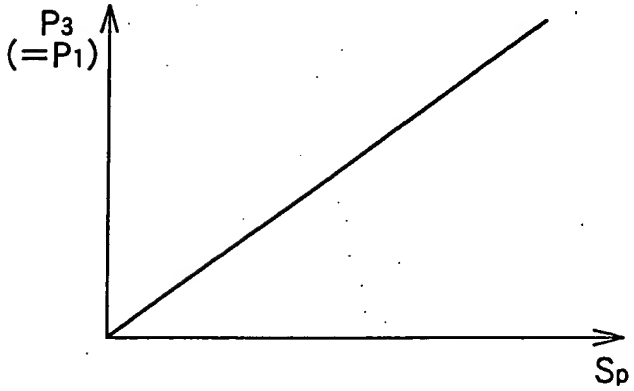

P3
(=P1)
Sp

FIG. 7

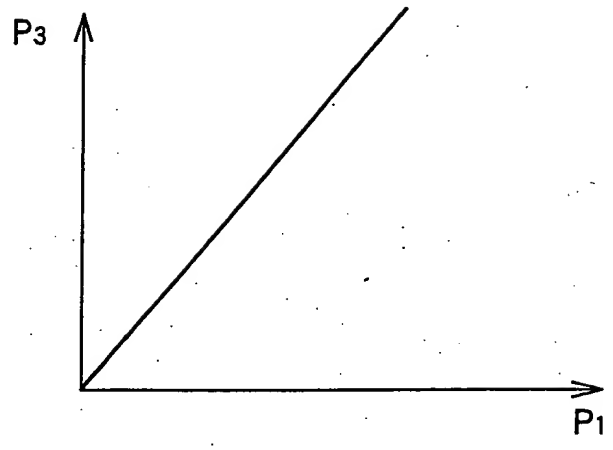


FIG. 8

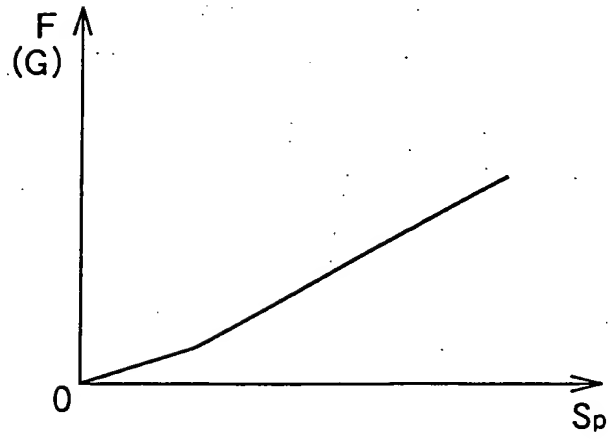


FIG. 9

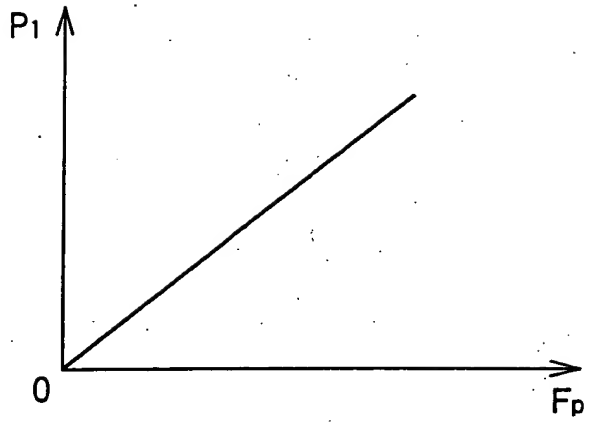


FIG. 10

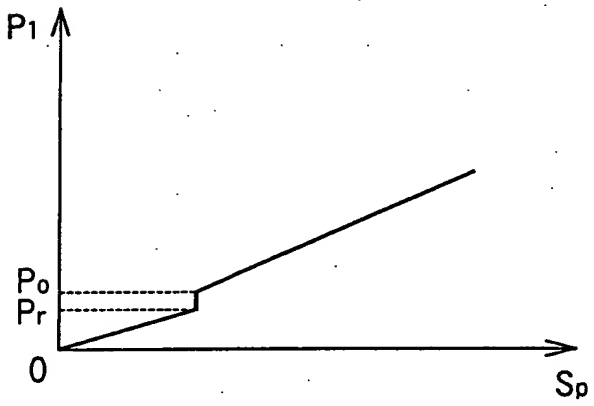


FIG. 11

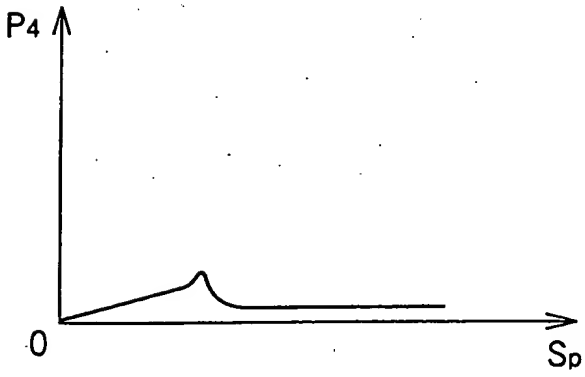


FIG. 12

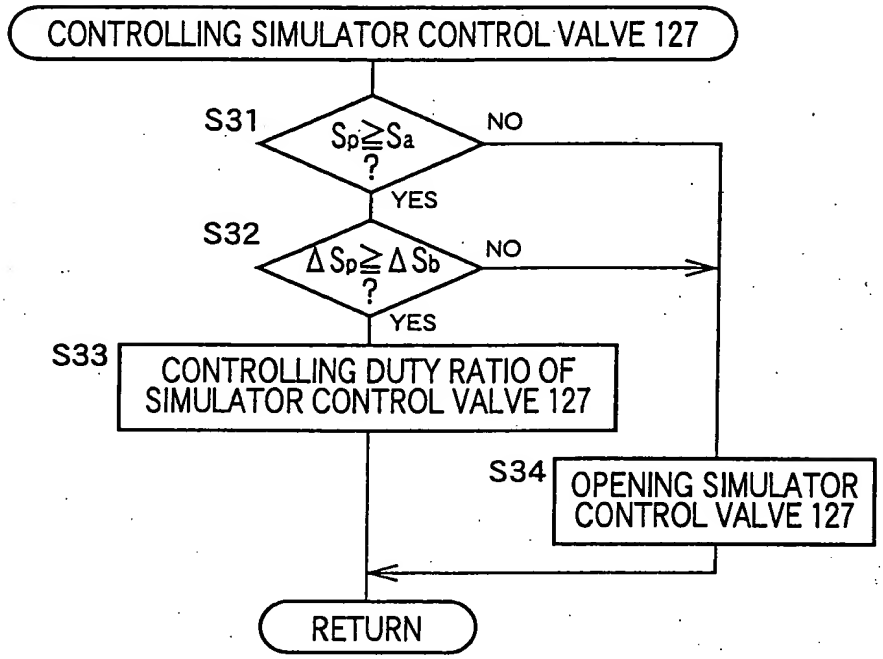
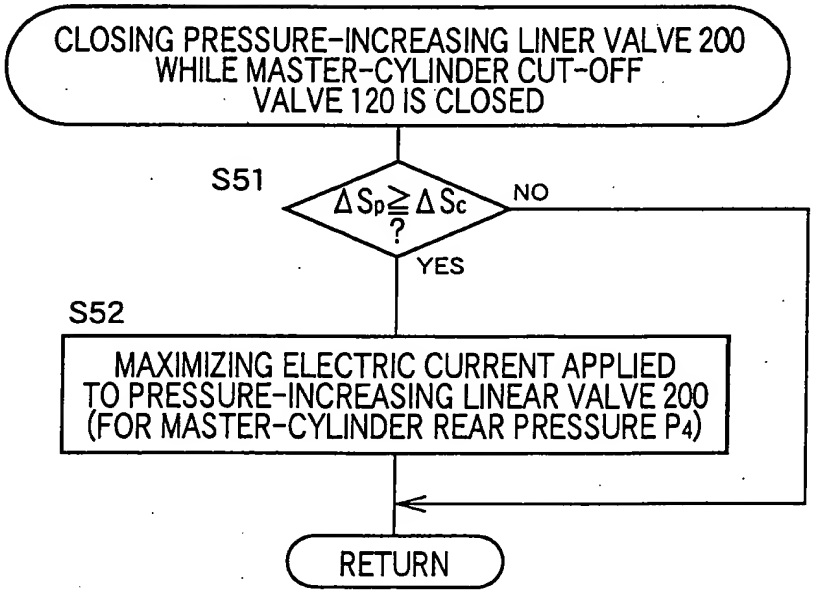

CONTROLLING SIMULATOR CONTROL VALVE 127
S31
Sp≧Sa ?
NO
YES
S32
ΔSp≧ΔSb ?
NO
YES
S33
CONTROLLING DUTY RATIO OF SIMULATOR CONTROL VALVE 127
S34
OPENING SIMULATOR CONTROL VALVE 127
RETURN

FIG. 13


CLOSING PRESSURE-INCREASING LINER VALVE 200 WHILE MASTER-CYLINDER CUT-OFF VALVE 120 IS CLOSED
S51
ΔSp≧ΔSc ?
NO
YES
S52
MAXIMIZING ELECTRIC CURRENT APPLIED TO PRESSURE-INCREASING LINEAR VALVE 200 (FOR MASTER-CYLINDER REAR PRESSURE P4)
RETURN

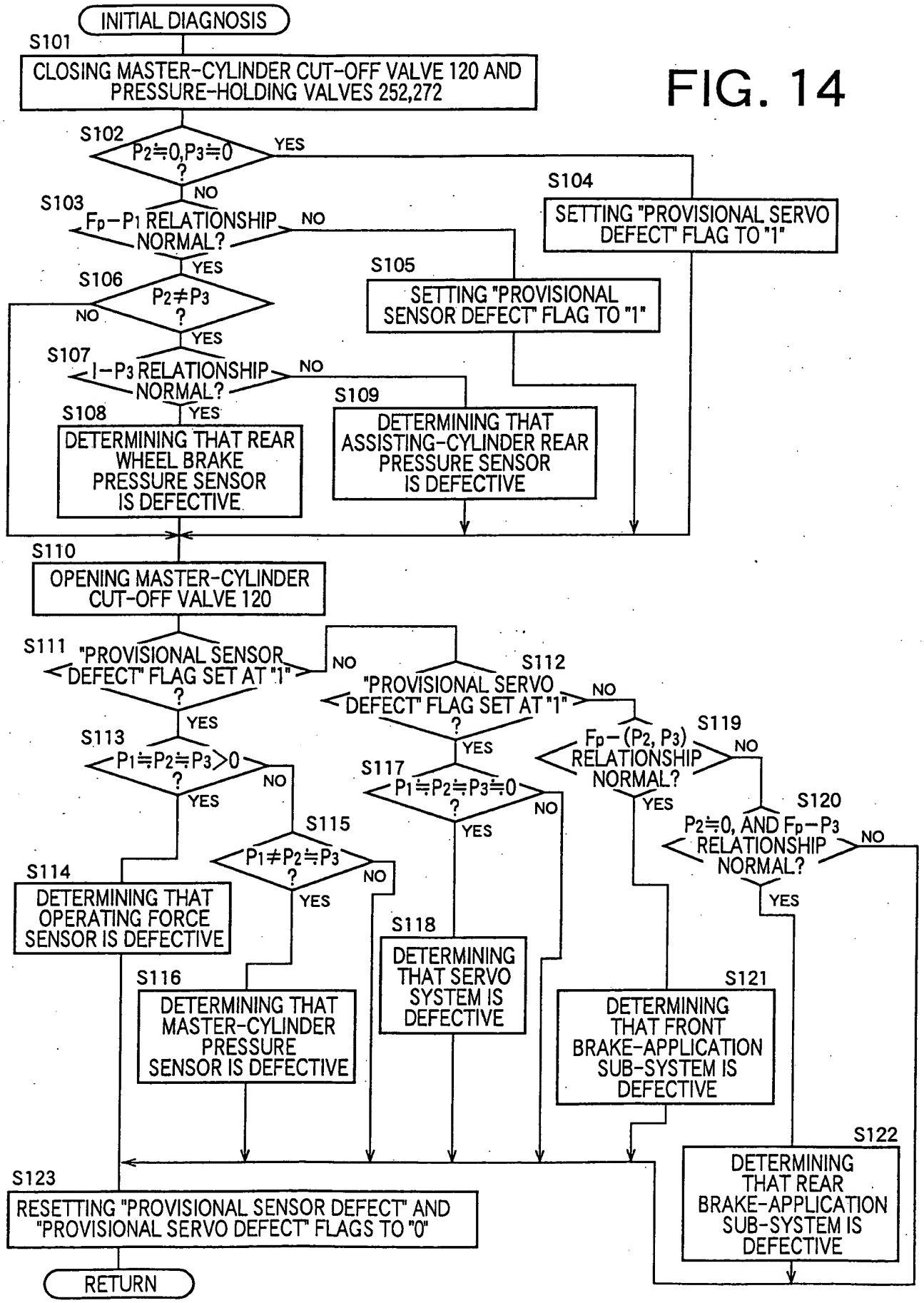

INITIAL DIAGNOSIS
S101
CLOSING MASTER-CYLINDER CUT-OFF VALVE 120 AND PRESSURE-HOLDING VALVES 252,272
S102
P2≒0,P3≒0 ?
YES
NO
S103
Fp−P1 RELATIONSHIP NORMAL?
NO
YES
S104
SETTING "PROVISIONAL SERVO DEFECT" FLAG TO "1"
S105
SETTING "PROVISIONAL SENSOR DEFECT" FLAG TO "1"
S106
P2≠P3 ?
NO
YES
S107
I−P3 RELATIONSHIP NORMAL?
NO
YES
S108
DETERMINING THAT REAR WHEEL BRAKE PRESSURE SENSOR IS DEFECTIVE
S109
DETERMINING THAT ASSISTING-CYLINDER REAR PRESSURE SENSOR IS DEFECTIVE
S110
OPENING MASTER-CYLINDER CUT-OFF VALVE 120
S111
"PROVISIONAL SENSOR DEFECT" FLAG SET AT "1" ?
NO
YES
S112
"PROVISIONAL SERVO DEFECT" FLAG SET AT "1" ?
NO
YES
S113
P1≒P2≒P3>0 ?
NO
YES
S114
DETERMINING THAT OPERATING FORCE SENSOR IS DEFECTIVE
S115
P1≠P2≒P3 ?
NO
YES
S116
DETERMINING THAT MASTER-CYLINDER PRESSURE SENSOR IS DEFECTIVE
S117
P1≒P2≒P3≒0 ?
NO
YES
S118
DETERMINING THAT SERVO SYSTEM IS DEFECTIVE
S119
Fp−(P2, P3) RELATIONSHIP NORMAL?
NO
YES
S120
P2≒0, AND Fp−P3 RELATIONSHIP NORMAL?
NO
YES
S121
DETERMINING THAT FRONT BRAKE-APPLICATION SUB-SYSTEM IS DEFECTIVE
S122
DETERMINING THAT REAR BRAKE-APPLICATION SUB-SYSTEM IS DEFECTIVE
S123
RESETTING "PROVISIONAL SENSOR DEFECT" AND "PROVISIONAL SERVO DEFECT" FLAGS TO "0"
RETURN

FIG. 14

FIG. 15

MASTER-CYLINDER CUT-OFF VALVE 120		ELEMENTS DETERMINED TO BE DEFECTIVE
IN CLOSED STATE	IN OPEN STATE	
$P_2, P_3 \fallingdotseq 0$	$P_1, P_2, P_3 \fallingdotseq 0$	DEFECTIVE SERVO SYSTEM
ABNORMAL F_P-P_1 RELATIONSHIP	$P1 = P2 = P3$	DEFECTIVE OPERATING-FORCE SENSOR 330
ABNORMAL F_P-P_1 RELATIONSHIP	$P_1 \neq P_2 = P_3$	DEFECTIVE MASTER-CYLINDER PRESSURE SENSOR 340
$P_2 \neq P_3$, AND NORMAL F_P-P_3 RELATIONSHIP	($P_1 \neq P_2$)	DEFECTIVE REAR WHEEL BRAKE PRESSURE SENSOR 338
	$P_1 \fallingdotseq 0$, AND NORMAL F_P-P_2, P_3 RELATIONSHIP	DEFECTIVE FRONT SUB-SYSTEM
	$P_2 \fallingdotseq 0$, AND NORMAL F_P-P_3 RELATIONSHIP	DEFECTIVE REAR SUB-SYSTEM

FIG. 16

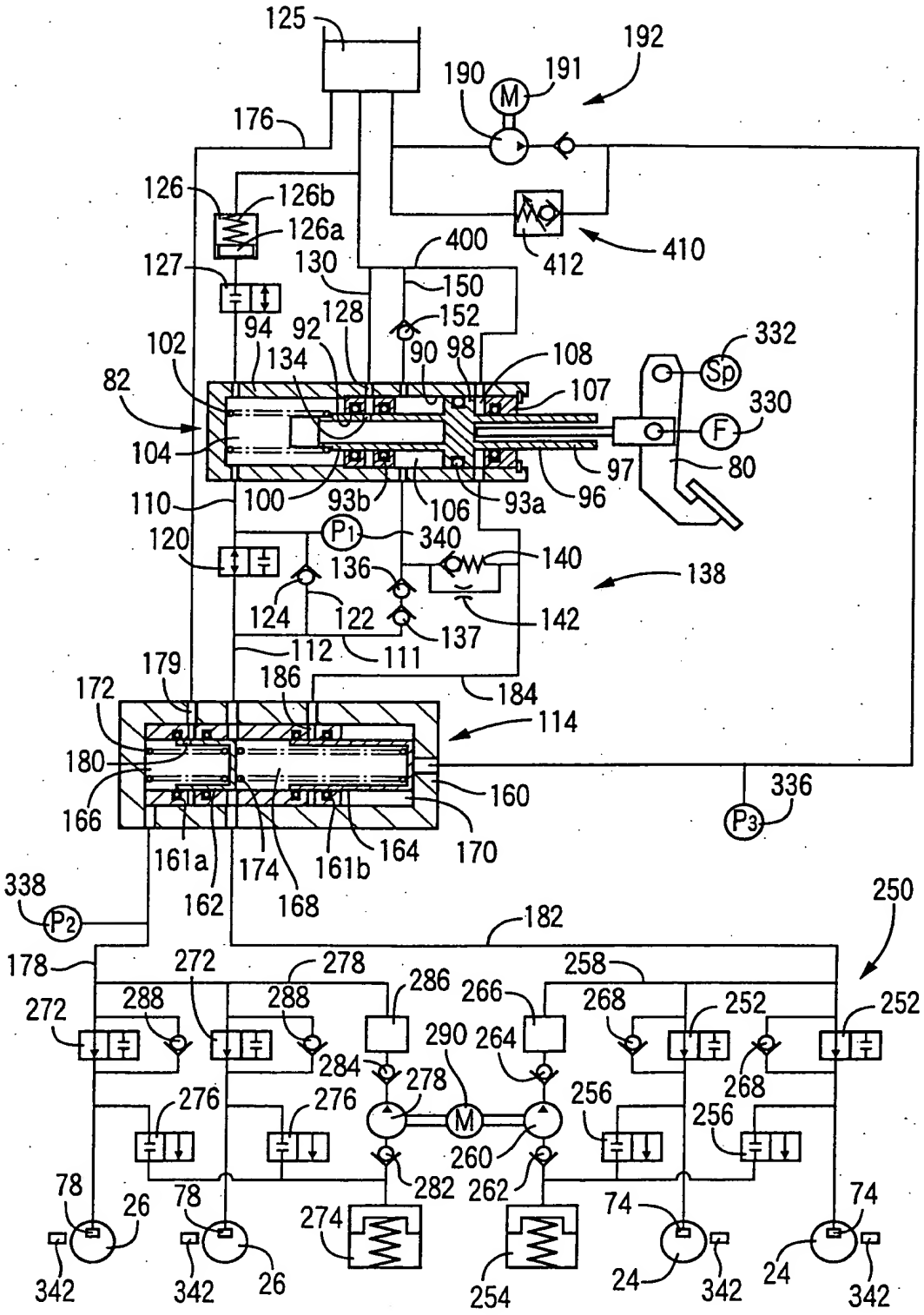

125
192
190
191
M
176
126
126b
126a
400
410
412
127
130
150
94
92
128
152
90
98
102
134
108
332
Sp
82
107
330
F
104
97
80
110
100
93b
106
93a
96
P1
340
120
136
140
138
124
122
137
142
112
111
179
186
184
172
114
180
160
336
P3
166
161a
174
161b
164
170
338
P2
162
168
182
250
178
272
278
258
288
288
286
266
268
252
252
272
290
264
284
278
268
276
276
256
256
M
260
282
262
78
26
78
274
74
74
342
342
26
254
24
342
24
342

FIG. 17

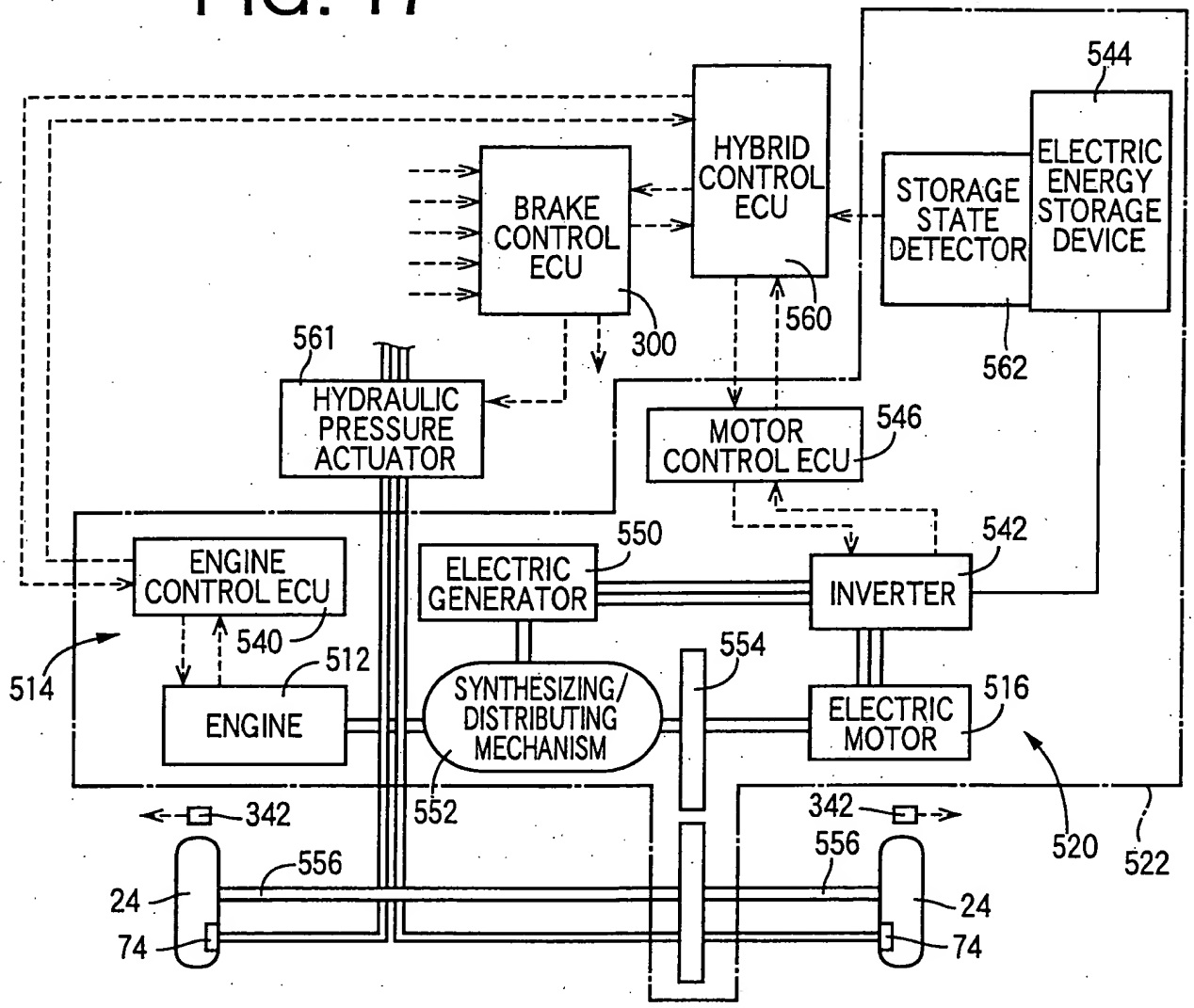
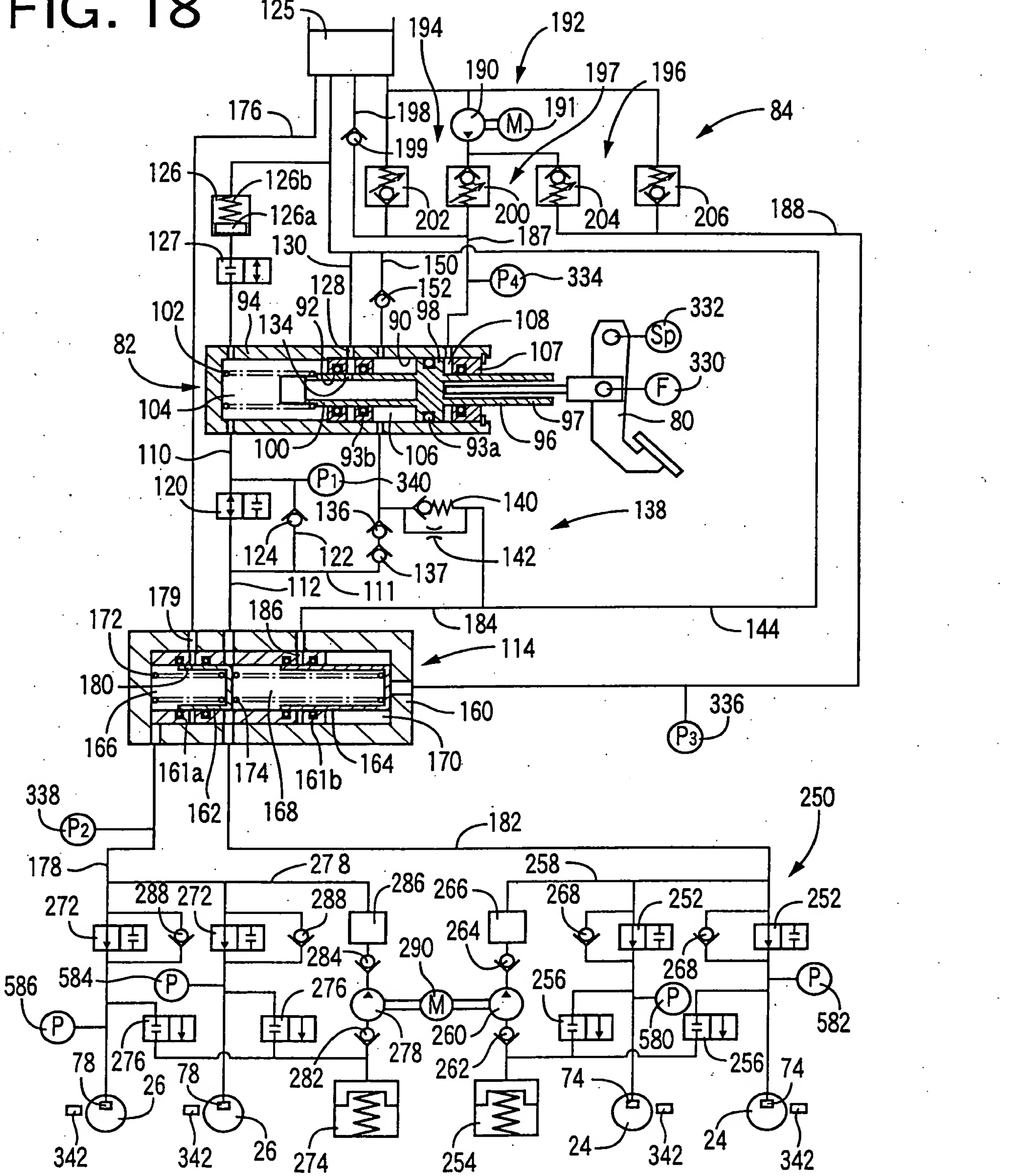

HYBRID CONTROL ECU
BRAKE CONTROL ECU
STORAGE STATE DETECTOR
ELECTRIC ENERGY STORAGE DEVICE
544
560
300
562
561
HYDRAULIC PRESSURE ACTUATOR
MOTOR CONTROL ECU
546
ENGINE CONTROL ECU
550
ELECTRIC GENERATOR
542
INVERTER
540
512
514
554
ENGINE
SYNTHESIZING/ DISTRIBUTING MECHANISM
ELECTRIC MOTOR
516
342
552
342
556
556
520
522
24
24
74
74

FIG. 18



125
194
192
190
197
196
84
176
198
191
199
126
126b
202
200
204
206
188
126a
127
130
187
150
334
152
128
332
102
94
92
90
98
108
82
134
107
330
104
100
93b
106
93a
96
97
80
110
340
120
136
140
138
124
122
142
137
112
111
179
186
184
144
172
114
180
160
166
161a
174
161b
164
170
336
338
162
168
250
182
178
278
258
286
266
272
288
268
252
284
290
264
586
584
276
256
582
260
580
78
26
282
262
74
24
342
274
254

FIG. 19

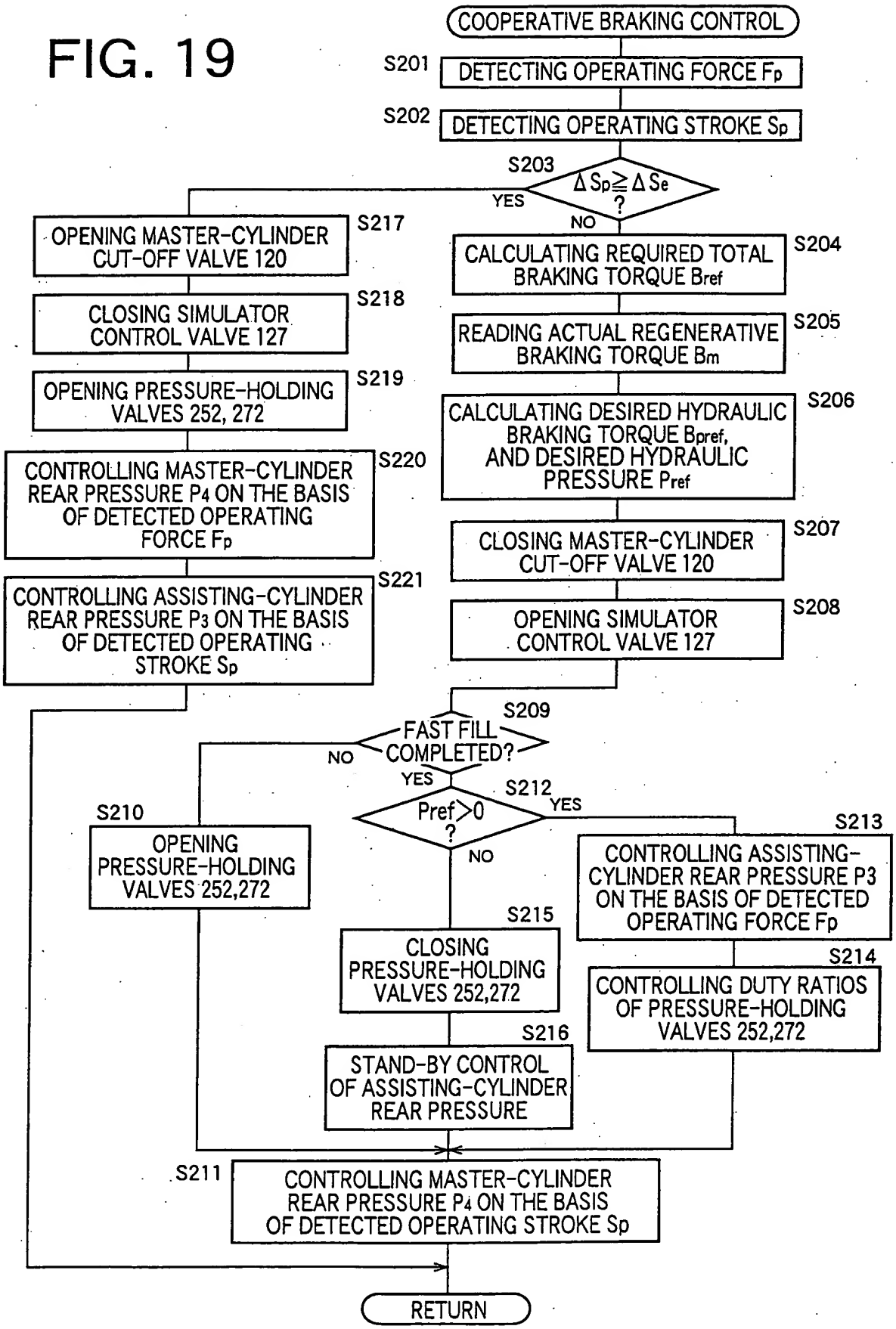

COOPERATIVE BRAKING CONTROL
S201
DETECTING OPERATING FORCE Fp
S202
DETECTING OPERATING STROKE Sp
S203
ΔSp≧ΔSe ?
YES
NO
S217
OPENING MASTER-CYLINDER CUT-OFF VALVE 120
S218
CLOSING SIMULATOR CONTROL VALVE 127
S219
OPENING PRESSURE-HOLDING VALVES 252, 272
S220
CONTROLLING MASTER-CYLINDER REAR PRESSURE P4 ON THE BASIS OF DETECTED OPERATING FORCE Fp
S221
CONTROLLING ASSISTING-CYLINDER REAR PRESSURE P3 ON THE BASIS OF DETECTED OPERATING STROKE Sp
S204
CALCULATING REQUIRED TOTAL BRAKING TORQUE Bref
S205
READING ACTUAL REGENERATIVE BRAKING TORQUE Bm
S206
CALCULATING DESIRED HYDRAULIC BRAKING TORQUE Bpref, AND DESIRED HYDRAULIC PRESSURE Pref
S207
CLOSING MASTER-CYLINDER CUT-OFF VALVE 120
S208
OPENING SIMULATOR CONTROL VALVE 127
S209
FAST FILL COMPLETED?
NO
YES
S212
Pref>0 ?
YES
NO
S210
OPENING PRESSURE-HOLDING VALVES 252,272
S213
CONTROLLING ASSISTING-CYLINDER REAR PRESSURE P3 ON THE BASIS OF DETECTED OPERATING FORCE Fp
S214
CONTROLLING DUTY RATIOS OF PRESSURE-HOLDING VALVES 252,272
S215
CLOSING PRESSURE-HOLDING VALVES 252,272
S216
STAND-BY CONTROL OF ASSISTING-CYLINDER REAR PRESSURE
S211
CONTROLLING MASTER-CYLINDER REAR PRESSURE P4 ON THE BASIS OF DETECTED OPERATING STROKE Sp
RETURN

FIG. 20

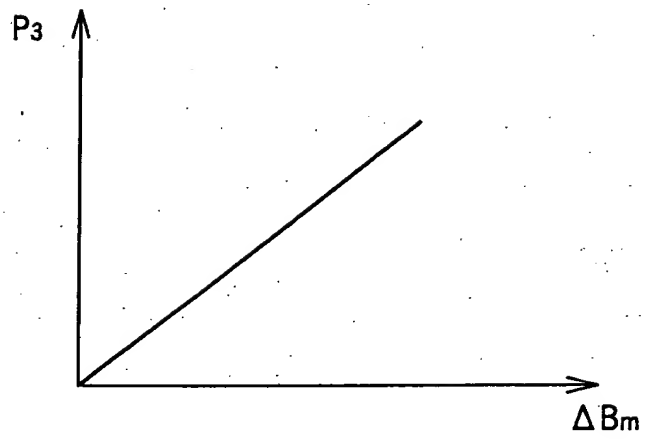


FIG. 21

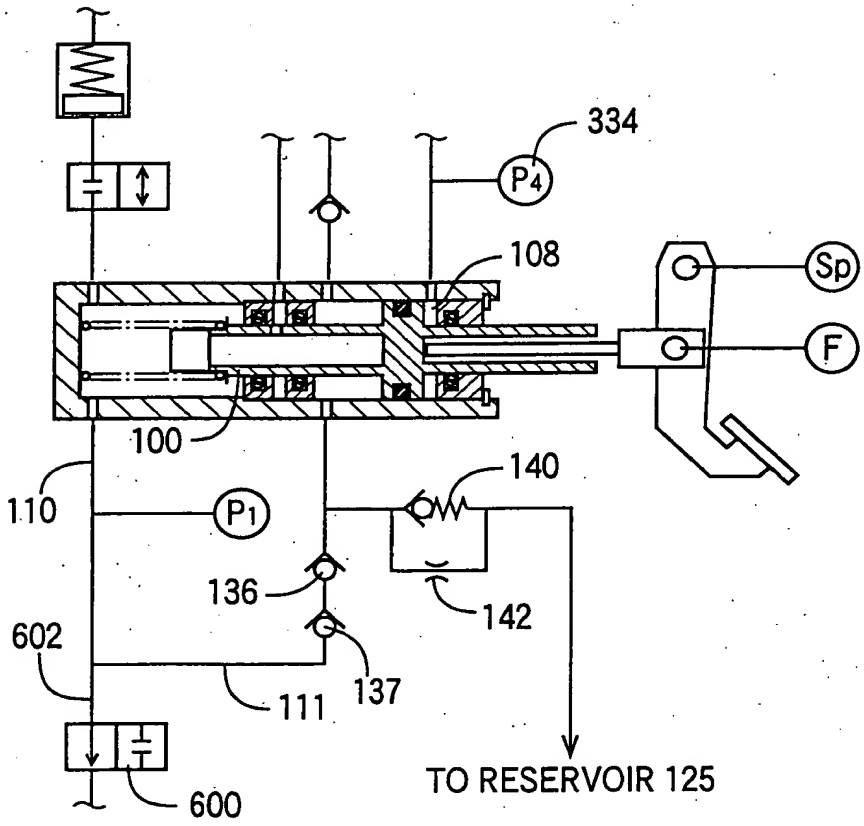

334
P4
108
Sp
F
100
110
P1
140
136
142
602
137
111
600
TO RESERVOIR 125

FIG. 22

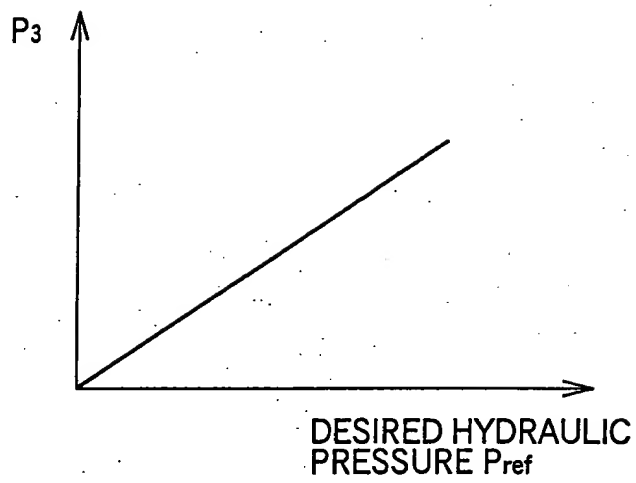


FIG. 23

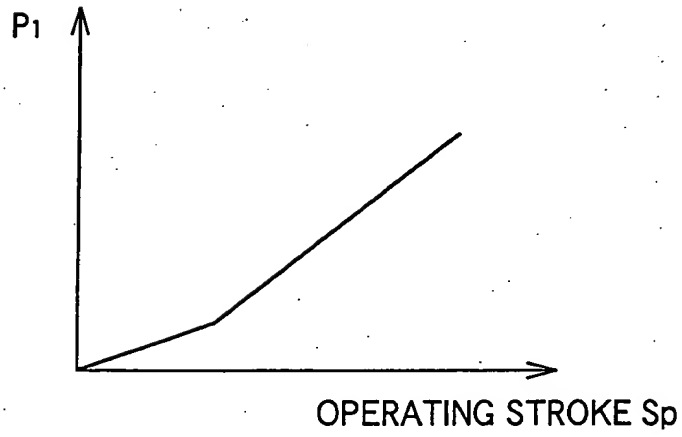


FIG. 24

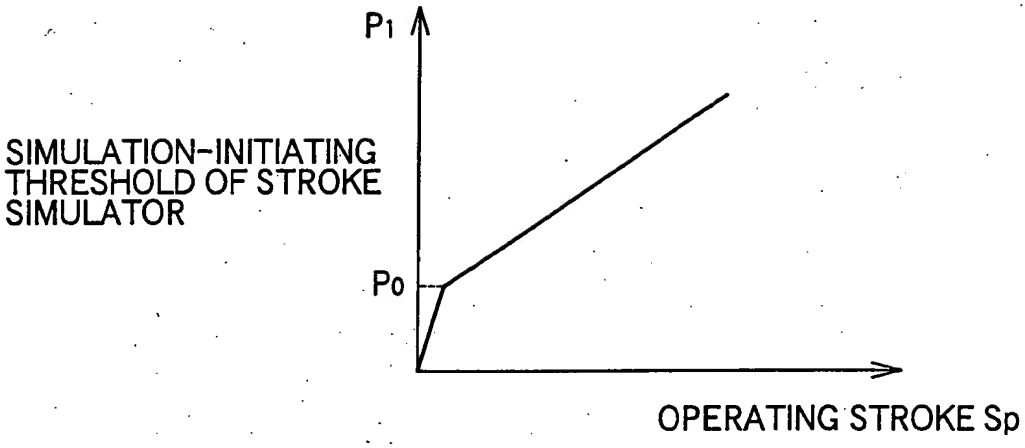

P1
SIMULATION-INITIATING THRESHOLD OF STROKE SIMULATOR
P0
OPERATING STROKE Sp

FIG. 25

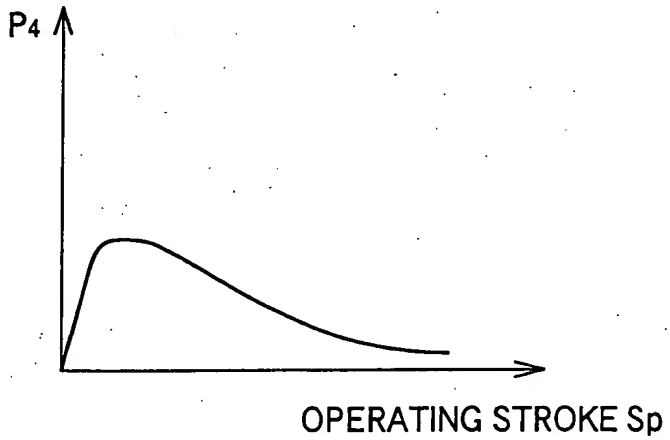

P4
OPERATING STROKE Sp

FIG. 26

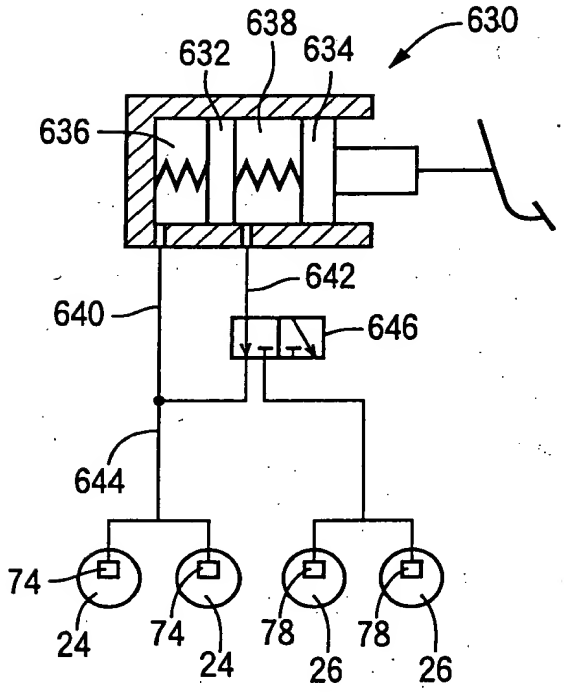


FIG. 27

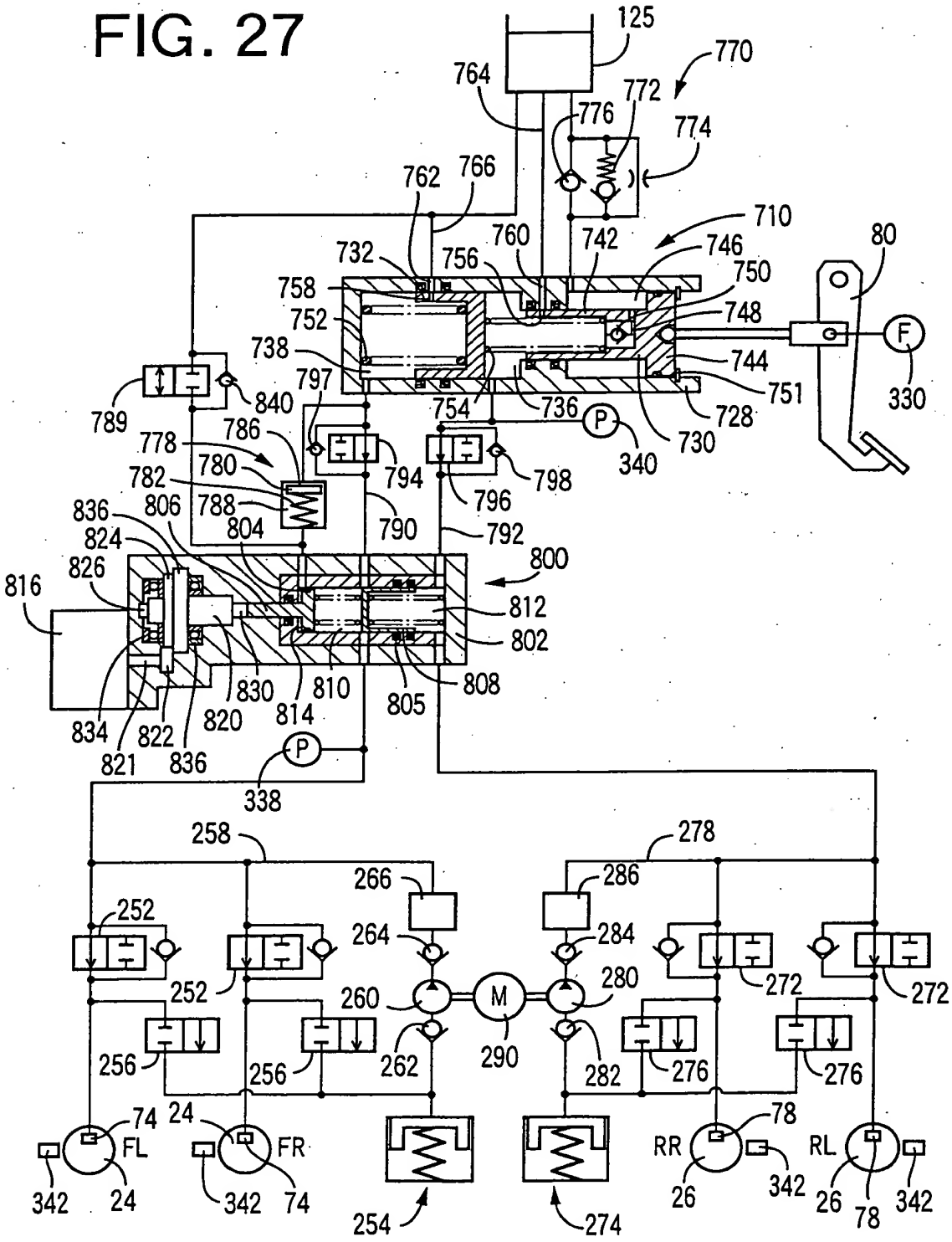
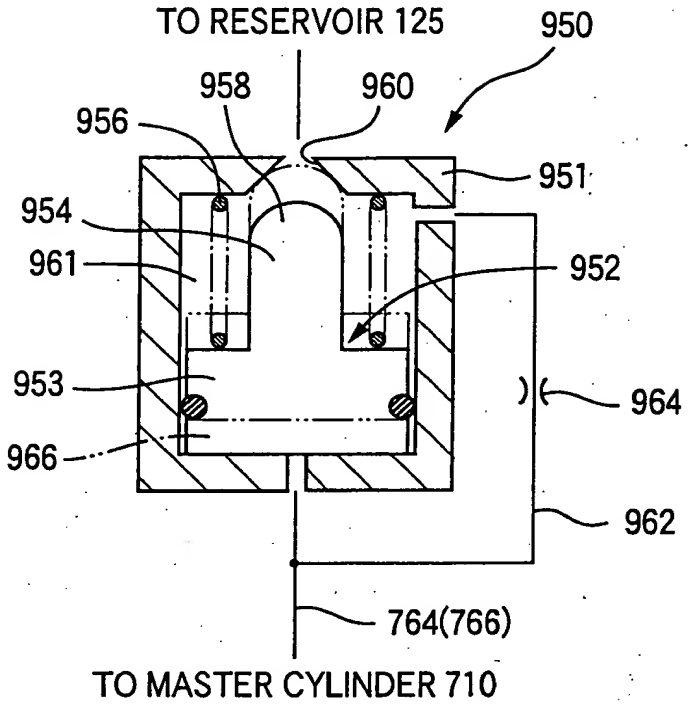

125
770
764
772
776
774
762
766
710
760
742
746
80
732
756
750
758
752
748
F
738
744
797
751
789
840
754
736
P
728
330
786
730
778
340
780
794
798
782
796
806
788
790
792
836
804
824
800
826
816
812
802
830
810
808
834
822
820
814
805
821
836
P
338
258
278
266
286
252
264
284
252
260
M
280
272
272
256
256
262
290
282
276
276
74
24
78
FL
FR
RR
RL
342
24
342
74
254
274
26
342
26
78
342

FIG. 28


TO RESERVOIR 125
950
958
960
956
951
954
961
952
953
964
966
962
764(766)
TO MASTER CYLINDER 710